EXHIBIT D

Report of Andre Falco Jimenez

I. Documents Reviewed:

A. Affidavit of Sanford Angelos;

B. Affidavit of Dr. Lawrence Myers;

C. Affidavit of David Kroyer;

D. Claimants' Answer to Government's Motion for Summary Judgment;

E. Affidavit of Officer Richard King 6/24/2010, including attachments (Photos, Various Logs, and Certification);

F. Government's "Deny's False Alert Summary";

G. Affidavit of Officer Richard King 12/21/2010;

H. Preliminary Report of Dr. Lawrence Myers;

I. Transcripts of Testimony from April 26-27, 2004 Motion to Suppress; and

J. United States v. Marrocco, 730 F.3d 711 (7th Cir. 2013)

II. Qualifications:

Please see attached Curriculum Vitae, Exhibit A.

III. Case Participation:

Please see attached Curriculum Vitae, Exhibit A.

IV. Opinion:

I reviewed and studied all case-specific documents I received from Komie & Associates, which are itemized in Roman I. In addition, I have reviewed and studied a wealth of scientific and educational materials related to the field of canine specific odor detection throughout my 30 years career as a certified canine specific odor detection trainer. Due to the number of sources I have reviewed over the past 30 years, a definitive list is impossible. However, when applicable in this opinion, I shall attempt to detail any specific scientific or continuing education materials upon which I attribute my opinion.

There are several issues I have determined that render the purported canine sniff (search) and eventual seizure (by law enforcement) of the Defendant Res invalid. Most predominately, many of the issues affecting the reliability and invalidity of Deny's purported sniff test are due to improper training techniques and deployment techniques that were popular at the time of Deny's and his Handler, Officer Richard King's, (hereinafter, "the team") tenure (late 90s and early 2000s.) From the records, it appears that the team's training suffered from many, if not all, of the training inadequacies of that era. Since that time (90s/early 2000s), many of the techniques used to train the team have been significantly changed or completely removed from common training and deployment practices for detection dogs, because we now know that these techniques create unreliable detector dogs.

A review of the training documents reveals that there is no evidence that Officer Richard King, or his department, trained or certified the team to alert to only detecting narcotics tainted United States Currency and to ignore (not alert to) untainted currency. Based on the number of "finds" referred to in the "field" records, this is critical to maintain the integrity of the team. This is a critical error which completely destroys any reliability of the team. The reason is because the failure to maintain this integrity will result in a dog being trained to alert to all currency.

Compounding this critical error, Officer King admitted that he rewarded Deny when he alerted in the field. This is a significant error because "rewarding" a dog in the field, especially after "currency finds," teaches (or reinforces) a dog to locate and alert upon the odor he last sniffed. In the case of United States Currency finds, this translates to training and rewarding the dog to find currency. It is impossible to expect the dog to differentiate between the odor of the currency and any alleged narcotics' odor even if it was, in fact, present. In all cases, the odor of the United States Currency will always be the prevailing odor for the dog. Therefore, the dog will be trained (even if inadvertently) to add the odor of the currency itself to his "trained odor" repertoire. In practice this error will result in a dog alerting on US Currency, regardless of whether the currency is tainted with narcotics odor or not. In this case, it is my opinion that King's practice of rewarding Deny in the field, as detailed above, completely renders Deny's alerts to currency unreliable.

Another error that is made clear from the training documents is that the training locations were not varied and unique enough to ensure the team did not develop habitual behaviors (or simply, "bad habits") that compromise reliability. These bad habits concern both dog handling and the accuracy of locating trained odors. This is confirmed by the handler's impossible belief that Deny was "never" wrong and had "never" ever (in his beliefs and experience) missed an odor or cleared a location that did not have narcotics' odor present. What we know for certain in the detection dog industry, is that no dog is perfect; no handler is perfect; and no team combination is perfect. And over the years what we have also learned is that the easiest way to create the illusion proffered by Officer King is to not vary one's training locations and to not create realistic challenges for the teams one is training. The reason varied training is critical is because an unvaried training regimen will lead to a dog learning how to be successful (getting rewarded) as opposed to maintaining the necessary behaviors to locate the desired narcotics' odors.

The error of utilizing an unvaried training regimen is particularly important given the search conditions existing in this case. I am of the further opinion that the search involved in this case was unreliable due to how the dog was trained and maintained. If a dog is trained and maintained in the manner that is described in both the handler's affidavit(s) and the provided documents, the dog simply learns to be successful (getting rewarded) by following, not the odor of narcotics or even the odor of currency, but by locating the freshest human odor in a room, particularly, human hand odor. As the search in question was described, the currency was brought into the room and "hidden" in a specific location.[1] According to the handler, the dog was then brought into the room to locate the desired substance: the currency. Utilizing improper training techniques as I described, a dog (here, Deny) learns to be successful at this locating "game" by finding (by its olfactory sense) the most recent human odor from the person who "hid" the substance by locating this scent and tracking it on the ground, air, and on the items in the room. The dog then follows the human odor by tracking it to the location where the substance is "hidden." The dog will easily locate the visually "hidden" substance that has the same human odor that he tracked and potentially, a recognized substance (in this case, United States Currency). After which, the dog's improper behavior (or bad habit) is reinforced by rewarding the dog. Such is precisely what happened in this case: Deny's unreliable alert was improperly rewarded.

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[1] Whether an item is visually hidden is really quite irrelevant to a canine. This improper and irrelevant fact is based on the false, anthropomorphic concept that dogs "see" their world utilizing same senses that humans do. In fact, dogs do not rely on their visual sense nearly as much as humans do; conversely, humans do not rely on their olfactory sense nearly as much as dogs do.

I also note that there is some discrepancy in the record as to the location the bag was allegedly hidden. This discrepancy does not alter my ultimate opinion because as I stated, the use of the term "hidden" is relative. Hence, "visually hiding" an object (a human concept) does not translate to "hiding" an object from a dog's sense of smell. Nevertheless, I have considered both scenarios in my analysis.

In over 30 years of training thousands of dogs and their handlers, I have seen this happen on innumerable occasions. I have also proven my point by conducting a confirmatory test. I hide NON-NARCOTIC items and substances, and then have the team search for suspect items. In my years, I have used such things as pencils, empty wallets, and car keys, for example, and hidden them in a room or vehicle. The result is often a "positive" indication from dog teams for the presence of the suspect odor when in fact absolutely zero odor was present.

This well-known phenomenon was demonstrated (and scientifically confirmed) in a published study conducted by Lisa Lit, a professor at University of California at Davis. See attached Exhibit B, Lit, L., Handler Beliefs Affect Scent Detection Dogs Outcomes, 14 ANIMAL COG. 3 at 389 (2011).

Another critical error in this case is that it appears the handler also had a preexisting idea going into the search that a positive find was imminent. This is problematic in that under these conditions, a dog-handler team will search until successful. The team should never believe that a "find" is mandatory or probable. Even though the handler did not know for sure the suspect currency was actually used in trafficking narcotics, his belief appears to be that the currency was.

As a former Police Officer for the City of Anaheim, California, I am well aware that the seizure of such a large amount of money was encouraged by my colleagues in Law Enforcement. The need or desire to obtain an alert can override the realities of what is true. I was able to demonstrate this fact for a documentary I recently filmed for Reason Magazine in 2013. I used a Bed Bug Detection Dog to search a vehicle. I demonstrated how I was able to obtain a positive dog alert to the trunk of a vehicle that neither had bed bugs in it nor ever had bed bugs in it. I was able to coax the alert based on a desire to elicit an alert on the vehicle in question, not because it had bed bugs in it. This problem of "cueing" was also demonstrated in the aforementioned Lisa Lit published article. (Exh. B.)

In regard to the issue of "all money" being tainted with narcotics or the presence of methyl benzoate, this may be a very valid point and an issue further undermining the reliability of Deny's alert. However, in my expert opinion, it is far more likely based on my review of the case materials, and my experience, and expertise, that the dog-handler team in this case unreliably alerted to the subject currency as a result of demonstrably unreliable training and poor practices during in-service deployments. Notwithstanding, it is well documented that, in fact, virtually all circulated United States Currency is contaminated with trace amounts of controlled substances or narcotics of various origins, i.e., without limitation, cocaine, PCP, meth-amphetamine, heroin, etc. Therefore, this fact simply presents another reason to find Deny's alert to the currency to be unreliable.

The reality of unreliable training is further documented by the total lack of independent certifications for this dog-handler team. The only certificate in the record is one of purported completion of a training course administered by the Chicago Police Department by the same police agency. In other words, the CPD claimed to train the dog and then claimed to certify the dog's completion of the self-administered training. At no time is it indicated in the training logs that any valid, police canine organization tested and validated the effectiveness of the dog-handler team.

Even though the United States Police K9 Association was available and was considered a valid, independent source for certification, this team did not appear to participate in such certification. In more recent years it is not only encouraged in the industry, but it is also critical for a team to be certified by a valid, independent organization in order to insure reliability. And again this problem is validated by the handler's apparent belief that he and his dog have never failed and are perfect in both finding and clearing a location for narcotics. This is an obvious sign that the team only participated in "self training" and was never challenged to perform verification searches or deployments. And as stated, this "obvious sign" was confirmed by the training records (or more properly, the lack thereof) for the team.

I am of the additional opinion that the amounts of substance(s) used to train "Deny" indicated in the training logs is also low compared to today's standards. Very few times did the team appear to train on amounts more than a few grams of the target substance. As a matter of fact it appears the team regularly trained on amounts as little as 10 to 20 grams, and at times, even presumably microscopic amounts. (See e.g, King Affidavit at paragraph 28.) In more recent years, we have learned that this practice of using small samples for training negatively impacts reliability. The reason is because this teaches a dog to regularly alert to residual or trace amounts of narcotics. It is preferred that a dog be trained to locate "substantial" amounts of narcotics. In other words, amounts you can easily see with the naked eye.

Using relatively small amounts of substance to train is problematic because dogs trained in this incorrect manner will alert to locations that were merely touched by people who had previously been in contact with narcotics (prescription or marijuana cigarettes for instance). A real world example of this is when a passenger on a plane, who did not use or sell narcotics, dropped off his luggage at the curb pick up location for an airline. And a baggage attendant, who had just smoked a marijuana cigarette during his lunch break, touched and carried the same passenger's luggage. A drug dog trained on trace amounts of narcotics would alert to the handle of the suitcase and falsely implicate the innocent passenger. I have personally replicated this result in my training facilities and studies with narcotics detection dog teams. And again this issue is admitted to by the handler's sworn statement that when his dog alerted and nothing was found, it could be traced to someone who was in contact with narcotics or narcotic odor.

In my opinion, and for the reasons stated above, the sniff search conducted by the dog-handler team in this case is unreliable.

V. Compensation:

My initial retainer in this case was in the amount of $3,000.00. My hourly billable rate for general services is $250.00 per hour and for deposition or trial work it is $400.00 for the first hour and $300.00, thereafter.

By: [signature]
Andre Falco Jimenez

EXHIBIT-A

Andre Falco Jimenez
CV

EMPLOYMENT HISTORY

1983-1986	Reserve Police Officer, Anaheim Police Department
1986-2005	Police Officer, Anaheim Police Department
1992-1993	Instructor - Golden West College, Basic Academy
1992-2004	Instructor - Orange County Sheriff Department, Basic Academy
1992-1997	K-9 Team Trainer for the Anaheim Police Department
1995-1997	Instructor - *Work Dogs International*
1994-2005	Instructor - Anaheim Police Department's P.A.C.E. Program
1995-2004	Instructor - *K9 Academy for Law Enforcement*
1997-2000	Contributing Editor-*Dog Sports Magazine*
1995-Present	Owner/President of *Falco K9 Academy (Falco Enterprises, Inc)*
2001-Present	TASA expert for Detection Dogs, Police K9's and civilian dogs
2007-2012	Director, Jake's Dog Foundation
2011-2012	President of Falco K9 Security, Services and Investigations Inc

ASSIGNMENTS

1984-1987	Reserve Police Officer
1987-1989	Patrol Officer
1989-1996	Canine Officer
1999-2005	Patrol Officer
1991-1996	Anaheim Police S.W.A.T. Canine Team
1996-1999	SVU Detective (Family Crimes and Sex Crimes)

Author

Dog Sniff Evidence (**Number 1 Bestseller**)
Falco-Walking with God and Dog (ISBN)
8-Week Basic Handler Manual (ISBN)
Modern Decoying for the Patrol Dog
Detection Dog Manual

INSTRUCTOR, K9 CONFERENCES AND SEMINARS

Anaheim, California - Spring 1996
Orlando, Florida - Fall 1996
Ventura, California - April 1997
Houston, Texas - May 1997
Orlando, Florida - December 1997
San Jose, CA - May 1998
New London, Connecticut - October 1998
Ventura, California - June 1999
Tavares, Florida - March 2000
Boulder, Colorado - May 2000
Sacramento, California - October 2000
Houston, TX - January 2001
Lake County, Florida - March 2001
Portsmouth, New Hampshire - September 2001
Lake County, Florida - March 2002
New London, Connecticut - September 2002

Anaheim, California - September 2002
Lake County, Florida - April 2003
Phoenix, Arizona - October 2003
Lake County, Florida - March 2004
Phoenix, Arizona - September 2004
North Las Vegas, Nevada – October 2005
Utah State Police Officer Conference, Cedar City – 2006
Oregon Lawyers Association, Drugs and Searches Seminar September 2006
2007 - North Carolina Academy of Trial Lawyers, Meth 101– Defending a Meth Case
2008 Las Vegas Seminar on Detection Dogs – Planet Hollywood
2009 NACDL – Las Vegas, Nevada
NACDL –Portland, Oregon
NACDL – North Carolina
2010 Oregon Lawyers Association, Drugs and Searches Seminar November
NACDL Las Vegas
NACDL Houston, Texas
2011 Las Vegas Seminar on Bed Bug Detection Dogs – Orkin – the Golden Nugget
Oregon Lawyers Association, Drugs and Searches Seminar-November-Portland
2012 NACDL – Las Vegas
NACDL – Portland, Oregon
NACDL – Sun Valley, Idaho
National Press Corp/US Supreme Court, Washington DC Narcotics Detection
2013 Northern California German Shepherd Rescue – “Aggression and Training with Love and Respect”
2014 NACDL – Aspen, Colorado
2014 NACDL – Las Vegas, Nevada

CERTIFICATES

California Police Officer’s Standards and Training - Reserve Police Officer
California Police Officer’s Standards and Training - Basic
California Police Officer’s Standards and Training - Intermediate
California Police Officer’s Standards and Training - Advanced
California Police Officer’s Standards and Training - Police Canine Evaluator
San Jose State University - Homicide Investigation
Academy of Justice, Riverside, California - Advanced Canine Handler
Arizona Law Enforcement Canine Association, Inc. - Police Dog Civil Litigation
Arizona Law Enforcement Canine Association, Inc. - Criminal Psychological Profiles
Work Dogs International - Advanced Police Dog Agitation (200 hours)
Orange County Police Canine Association - SWAT Dog Deployments
Orange County Police Canine Association - Police Dog Civil Litigation
Orange County Police Canine Association - Tracking and Trailing
Orange County Police Canine Association - Canine Psychology
Chapman University - Criminal Investigation
Department of Justice - Dignitary Security

COURT RECOGNIZED K9 EXPERT

2013 – Allen vs Oregon
2013 – Rustad vs Loma Linda University
2013 – Marcellus Ramon vs State of Oregon
2013 – State of Nebraska vs Scott Knippelmeir
2013 – Oregon vs French
2013 – Oregon vs Lawson
2013 – Iowa vs Timothy Nebel
2013 – Chad Hillyer vs State of Illinois
2013 – Robert Capppiello vs State of California
2013 – Brian Barrett vs State of California
2013 – South Dakota vs Paul Miller
2012 – Arizona vs Jose Cruz
2012 – USA vs Woodcock
2012 – Tezona vs State of Califronia
2012 – Ohio vs Mendo Love
2012 – USA vs Wilson
2012 - USA vs Keller
2012 – USA vs Aispuro-Haros
2012 – John Davis vs Ohio
2011 – James Black vs Lindenwold Township, NJ
2011 – State of Maryland vs Taylor-Williams Ryan J
2010 – State of Illinois vs Elizabeth D Loveless
2010 – State of Maryland vs Wilson Timothy McCoy
2009 – State of California vs Michael Espalin
2008 – Vannessa Hargis v. Contra Costa, CA
2006 - Arizona vs Randal Harrell
2005 – Gerard Falzo, ET AL. V. County of Essex, ET AL.
2004 – Porras (Rincon) vs City of Fontana
2004 – Frank Robles v. City of Fontana
2004 – T. Vanetik v. Chapman Animal Hospital
2004 – Helen Deir v. City of Southgate
2003 – Williamson v. Barnes
2003 – Jimenez v. Thomas (unrelated)
2003 – State of Nevada v. M. Van Winkle
2003 – Puree v. La Pietra
2003 – United States v. A. Sanchez
2002 – J. Craig v. City of South Lake Tahoe
2002 – State of Wyoming v. J. Arlynn
2002 – State v. C. Wilkening
2001 – Connon v. Rosagno

Memberships

North American Police Working Dog Association (NAPWDA)
National Police K9 Association (Individual)
National Police K9 Association (Company)
World Detector Dog Organization (Certified Instructor)
Anaheim Police Officer's Association
Orange County Police Canine Association (Former President)
National Tactical Officer's Association

American Society for Industrial Security
Friends of the Anaheim Police K9 Unit
United States Police Canine Association
California Narcotics Canine Association

AWARDS AND CITATIONS

Received the Anaheim Police Departments – Career Achievement Award
Certificate of Recognition from the California State Assembly
City of Anaheim Citation - "Outstanding performance at K-9 Competitions"
Operations Division, "Officer of the Year."
Division Commander Commendation - "Canine Charity Fund Raiser"
Division Commander Commendation - "Community Service"
Division Commander Commendation - "Homicide Investigation"
Operation Division, "Officer Of the Month" for December 1995.

SPECIAL PROJECTS

- Developed the canine unit's, "Commercial Building Training Program."
- Anaheim Police Canine team equipment studies.
- Researched and located a new contract trainer for the Anaheim canine team.
- Produced and directed three charity benefit shows for the *Orange County Police Canine Association*. Raising over $150,000.00.
- President of the *Orange County Police Canine Association*.
- Certified by P.O.S.T. as a state police canine evaluator.
- Disney G.O.A.L.S. - Teach and coach the disadvantaged children of the Jeffrey/Lynne, Ponderosa Park and Guinida areas in the city of Anaheim.
- Traveled to Europe to study canine training. While there, I also tested and selected work dogs for five agencies. Including Anaheim PD.
- Coordinator for the *1996 International Police Canine Conference*.
- Invented and improved on police and police canine equipment for training and on the job.
- Developing an "E-coli" Detection Dog for the State of California (In progress 2008).

EXHIBIT-B

Anim Cogn
DOI 10.1007/s10071 010 0373 2

ORIGINAL PAPER

Handler beliefs affect scent detection dog outcomes

Lisa Lit · Julie B. Schweitzer · Anita M. Oberbauer

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Abstract Our aim was to evaluate how human beliefs affect working dog outcomes in an applied environment. We asked whether beliefs of scent detection dog handlers affect team performance and evaluated relative importance of human versus dog influences on handlers' beliefs. Eighteen drug and/or explosive detection dog/handler teams each completed two sets of four brief search scenarios (conditions). Handlers were falsely told that two conditions contained a paper marking scent location (human influence). Two conditions contained decoy scents (food/toy) to encourage dog interest in a false location (dog influence). Conditions were (1) control; (2) paper marker; (3) decoy scent; and (4) paper marker at decoy scent. No conditions contained drug or explosive scent; any alerting response was incorrect. A repeated measures analysis of variance was used with search condition as the independent variable and number of alerts as the dependent variable. Additional nonparametric tests compared human and dog influence. There were 225 incorrect responses, with no differences in mean responses across conditions. Response patterns differed by condition. There were more correct (no alert responses) searches in conditions without markers. Within marked conditions, handlers reported that dogs alerted more at marked locations than other locations. Handlers' beliefs that scent was present potentiated handler identification of detection dog alerts. Human more than dog influences affected alert locations. This confirms that handler beliefs affect outcomes of scent detection dog deployments.

Keywords Dog · Canine · Scent detection · Social cognition · Interspecies communication

L. Lit
Department of Neurology, University of California at Davis, Sacramento, CA 95817, USA

J. B. Schweitzer
Department of Psychiatry and Behavioral Science, University of California at Davis, Sacramento, CA 95817, USA

A. M. Oberbauer
Department of Animal Science, University of California at Davis, Davis, CA 95616, USA

L. Lit (✉)
M.I.N.D. Institute, University of California at Davis, 2805 50th Street, Room 2415, Sacramento, CA 95817, USA
e mail: llit@ucdavis.edu

Introduction

In the early twentieth century, a horse named Clever Hans was believed to be capable of counting and other mental tasks. The psychologist Oskar Pfungst confirmed that Clever Hans was in fact recognizing and responding to minute, unintentional postural and facial cues of his trainer or individuals in the crowd (Pfungst 1911). The "Clever Hans" effect has become a widely accepted example not only of the involuntary nature of cues provided by onlookers in possession of knowledge unavailable to others, but of the ability of animals to recognize and respond to subtle cues provided by those around them. However, an additional important consideration was the willingness of onlookers to assign a biased interpretation of what they saw according to their expectations.

Experimental paradigms for investigation of animal behaviors are designed to minimize or eliminate confounds arising from the Clever Hans effect. Because the abilities of domestic dogs to respond to human social cues have been extensively documented (reviewed in Miklosi et al. 2007;

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Reid 2009), a Clever Hans effect might be particularly prevalent in dogs. Indeed, the reliance of some dogs on human cues has been shown to override olfactory or visual cues indicating the location of food (Szetei et al. 2003). In one experiment, about 50% of dogs would go to an empty bowl indicated by human pointing rather than to a bowl in which the dog had seen and smelled food (Szetei et al. 2003).

This finding was notable in view of the exceptional olfactory acuity in the domestic dog. Humans have capitalized on dogs' olfactory sensitivity through use in an ever-expanding array of scent detection activities (e.g., Horvath et al. 2008; McCulloch et al. 2006; Oesterhelweg et al. 2008; Wasser et al. 2004). Scent detection dogs search an area as directed by their handlers, issuing an operant trained response ("alert") upon detection of their trained scent. However, scent detection dog performance is not solely dependent on olfactory acuity. Cognitive factors such as context dependence (Gazit et al. 2005) and the interaction between training paradigm and the nature of the detection problem (Lit 2009; Lit and Crawford 2006) also can impact performance.

Because the alerting response is initially trained by handler cueing upon dog interest in the desired target scent (e.g., Wasser et al. 2004), it is possible that dogs are also being conditioned to respond to additional unintentional human cues. Generally, trained dogs, including search and rescue dogs, look at humans less than untrained dogs in experimental paradigms requiring dogs to solve a problem such as opening a container (Marshall-Pescini et al. 2009, 2008; Prato-Previde et al. 2008). Indeed, an inverse relationship between owner/handler dependence and problem-solving performance had previously been identified; that is, a more dependent relationship in companion dogs fostered impaired problem-solving performance compared with working dogs (Topal et al. 1997).

Yet given the social cognitive abilities of the domestic dog, it is possible that even highly trained dogs might respond to subtle, unintentional handler cues. Dogs' biases for utilizing human movements or social cues impair decision-making and reasoning abilities (Erdohegyi et al. 2007). Dog behavior is further affected by owner/handler gender and personality (Kotrschal et al. 2009). Moreover, dogs evaluate attentional cues of their owners through cues including eye contact and human eye, head and body orientation (Schwab and Huber 2006). Dogs can further distinguish the focus of human attention, using other visual cues such as pointing, gazing, head nodding in the direction of a target, glancing at a target and head turns toward a target affect selection of a target object by a dog (Soproni et al. 2001; Viranyi et al. 2004). In fact, nonverbal cues including proximity of the human to the dog and contextual learning of verbal commands have been shown to moderate dog response to verbal commands (Fukuzawa et al. 2005).

For scent detection dog handlers, beliefs that scent is present might result in either sufficient inadvertent postural and facial cues so that dogs will respond regardless of the absence of scent, beliefs that dogs are providing their trained alert response or simply beliefs that alerts should be called regardless of dog behavior. All of these effects would result in false alerts identified by handlers. These handler beliefs might be influenced by human communication regarding target scent location. Alternatively, handler beliefs might be influenced by increased dog interest in a nontarget scent. The main questions of this study were to (1) determine whether handler beliefs affect detection dog outcomes and (2) evaluate relative importance of dog versus human influences on those beliefs. The present study attempted to determine whether handler beliefs of target scent location would affect outcomes in scent detection dog searches. Importantly, this study was not evaluating abilities of these detection dogs to detect their target scents. Because all dogs were certified, many with confirmed deployment finds their ability to correctly locate target scent was considered to be previously established. Therefore, in order to evaluate outcomes solely based on handler beliefs and expectations, this study was designed so that any alert issued would be a "false" alert; that is, there was no target scent present in any searches conducted for the purposes of this study.

Materials and methods

Handler/dog teams

A total of 18 handler/detection dog teams, recruited through word-of-mouth from multiple agencies, participated in this study. These teams were certified by a law enforcement agency for either drug detection ($n = 13$), explosives detection ($n = 3$), or both drug and explosives detection ($n = 2$). Demographic details of teams, including dog age, dog breed, dog years of detection experience and handler years of detection experience are presented in Table 1. Upon detection of target scent, all explosives dogs, both drug/explosives dogs and one drug detection dog were trained to issue a passive alert; that is, the dog would sit at the location of target scent detection. One drug detection dog was trained to issue a passive active alert (sitting and barking), and all remaining drug dogs were trained to issue an active alert (barking) upon detection of target scent. All drug detection teams and two teams trained to find explosives had successfully identified their target scents in law enforcement deployment situations. Additional demographic information collected included handler years of experience handling detection dogs, dog years of scent detection experience, dog age and handler-reported breed of dog. In order to maintain

Table 1 Demographic data, *n* 18 dog/handler teams

	Day	1	2	All
Dog sex	Male intact	4	9	13
	Male neutered	1	0	1
	Female intact	2	1	3
	Female spayed	0	1	1
Dog breed	GSD	2	1	3
	Labrador	1	0	1
	Belgian malinois	3	5	8
	Dutch shepherd	0	2	2
	Mix	1	3	4
Dog age (years)	Mean	5.0	7.2	6.4
	Median	4.0	6.0	5.8
	Low	2.0	5.0	2.0
	High	10.0	11.0	11.0
Handler scent experience (years)	Mean	5.6	4.0	4.6
	Median	2.0	3.0	3.0
	Low	1.0	1.0	1.0
	High	18.0	7.0	18.0
Dog scent experience (years)	Mean	2.2	3.3	2.9
	Median	1.3	2.0	1.5
	Low	1.0	0.4	0.4
	High	5.0	7.0	7.0

confidentiality, and so that individual teams could not be identified through demographic information, these data were collected anonymously and cannot be linked to any performance data. Due to subject availability, this study was completed across 2 days, with seven teams completing the experiment on the first day, and the remaining 11 teams completing the experiment on the second day.

Procedures

The experimental paradigm in this study was based on a paradigm previously applied to evaluate response conflict in disaster search dogs (Lit and Crawford 2006). Handlers conduct a series of short searches for their target scent across different search scenarios, each representing a different experimental condition. In the current study, there was no target scent present, so that any alert identified by handlers was considered a false alert.

Handler beliefs were influenced either by verbally communicating to the handlers that a specific marker was an indicator of scent location (i.e., human influence), by encouraging dogs to display unusual interest in a specific location with a decoy scent (i.e., dog influence), or by a specific marker that actually indicated the location of a decoy scent (combined human and dog influence). A 4-way single factor experimental design was used to test effects of these influences on handler beliefs. The independent variable was search condition, a within-subjects variable with four levels:

1. *NULL* Unmodified.
2. *MARKED NULL* A piece of 8 1/2" × 11" red construction paper was taped to the door of a cabinet.
3. *UNMARKED DECOY* Two Slim-Jim sausages (removed from their wrappers and stored with their wrappers in an unsealed plastic bag) and a new tennis ball were hidden in the bottom of a pot and placed in a metal cabinet with the doors closed.
4. *MARKED DECOY* Two Slim-Jim sausages (removed from their wrappers and stored with their wrappers in an unsealed plastic bag) and a new tennis ball were hidden in a covered metal electric fryer, which was marked with a piece of red construction paper taped to the outside of the fryer. To minimize the possibility that decoy scents in UNMARKED DECOY and MARKED DECOY were not equally detectable and to encourage dog interest in the decoy scents, the sausages were rubbed along the outside of the cabinet (UNMARKED DECOY) and the electric fryer (MARKED DECOY).

Search conditions were four rooms within a church that had not previously been used for detection dog training purposes. Each room was approximately 30 40 m^2 and contained cabinets, tables and chairs and art supplies. Each condition was identified only as A, B, C or D, indicated by a paper taped on the outside of the door of each room. The experimenter did not touch any items around the rooms, except to place the decoy scents and/or paper markers. To avoid contamination of paper markers with decoy scents, paper markers were placed prior to placement of decoy scents. In order to maintain the belief that the experimenter was setting out target scents in each condition, at the beginning of each testing day, the experimenter carried a metal box containing 12 half-ounce samples of marijuana triple bagged in sealed plastic bags, and a canvas bag containing 12 half-ounce samples of gunpowder triple bagged in sealed plastic bags. Upon entering each condition, the experimenter immediately set these containers down by the door. The experimenter did not handle the scents, and the containers were never opened inside the church. Decoy scents and paper markers were never in contact with these containers and were kept in a separate briefcase carried by the experimenter.

Dog/handler teams completed two searches (maximum 5 min each) in each of the four search areas, for a total of eight trials ("runs") per team. Handlers were provided with a small card containing their assigned sequences of their eight runs, randomly counterbalanced across participants and search areas. Additional written and verbal instructions were provided to handlers that each condition might contain up to three target scents and that target scent markers consisting of a red piece of construction paper would be present in two conditions. No information was provided about the decoy scent.

Each condition had a single observer present. Prior to each search, handlers would indicate to the observer whether their dog was a drug or explosives dog and whether their dog issued a passive or active alert. When a handler "called an alert," that is, confirmed that the dog had found a target scent location and was issuing its trained operant response, the observer would record time of alert and alert location specified by the handler. In marked conditions, if handlers called alerts on the location marked by the paper, observers would record an M to reflect this. Observers recorded alerts as called by handlers and did not evaluate validity of alerts. The same rooms were used for both days of testing. Decoy scents and markers were removed at the end of the first day of testing, and identical but previously unused decoy scents and markers were used for the second day of testing.

This study was double-blind. Neither handler/dog teams nor observers were aware of the conditions of each search area. Because the study was completed across 2 days and we did not want to jeopardize the double-blind nature of this study, all handlers were debriefed and told about the contents of each condition upon the completion of the second day of testing. The experimenter (L. Lit) was the only person present who was aware of the conditions of each search area.

Dependent variables were total number of alerts issued by each dog as reported by handlers in each search area. The correct score for each search area was 0. All alerts were false alerts.

The Institutional Review Board and Animal Care and Use Committee at the University of California at Davis approved this study, and all participants provided written consent.

Statistical analyses

Data were analyzed using SPSS Version 17.0.1. All analyses used a significance threshold of $\alpha < 0.05$ (two-tailed). An omnibus mixed ANOVA was conducted to evaluate effects of day of testing (between groups) and condition (repeated measures) on number of alerts. To evaluate effects of handler influence and dog influence, data were also analyzed as a repeated measures 2×2 ANOVA [handler influence (yes/no) and dog influence (yes/no)]. Paired t tests were used to compare alerts between first and second runs of each condition. A chi-squared goodness of fit test compared clean runs (runs with no alerts) in unmarked and marked conditions. Within the MARKED NULL, UNMARKED DECOY and MARKED DECOY conditions, a log likelihood analysis was used to compare runs for which (1) alerts included either a marker or the unmarked decoy scent, (2) alerts did not include the marker or unmarked decoy scent and (3) no alerts were issued, followed by chi-squared goodness of fit tests to compare distribution of these within conditions.

Results

In order to evaluate effects of handler beliefs and expectation on detection dog performance, this study measured performance of 18 handler/dog teams in four separate search areas (NULL, MARKED NULL, UNMARKED DECOY, MARKED DECOY, described in "Materials and methods"). Each team ran each search area twice, for a total of 36 runs per condition (2 runs/team $\times$ 18 teams) and an overall total of 144 separate runs (4 search areas $\times$ 2 runs/team/area $\times$ 18 teams) (Fig. 1).

Day of testing and condition group differences

Overall, because multiple alerts per team within a condition were possible, there were a total of 225 alerts issued. There were 21 (15%) clean runs and 123 (85%) runs with one or more alerts. The omnibus mixed ANOVA using the model "number of alerts = day of testing (between groups) + condition (within-subjects) + [day of testing * condition]" revealed no difference in mean alerts between teams running on the first and second days, $F(1, 16) = 0.94$, $P = 0.35$; no

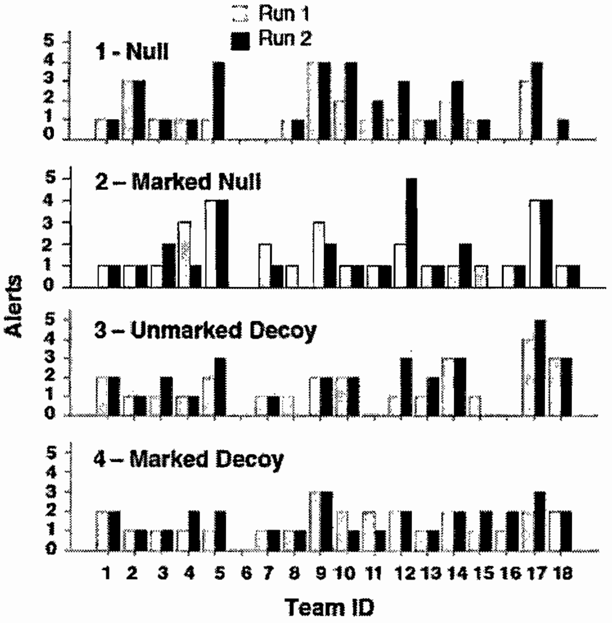

Fig. 1 Alerts for each team across each condition for Run 1 (*light bars*; *n* 18/condition) and Run 2 (*dark bars*; *n* 18/condition)

difference in mean alerts across conditions, $F(3,48) = 0.09$, $P = 0.97$; and no interaction, $F(3, 48) = 0.63$, $P = 0.60$. Data from both days were subsequently combined for further analysis. The repeated measures 2 × 2 factorial ANOVA found no main effect of human influence, $F(1, 17) = 0.06$, $P = 0.81$; no main effect of dog influence, $F(1, 17) = 0.01$, $P = 0.93$; and no interactions between human influence and dog influence, $F(1, 17) = 0.01$, $P = 0.94$.

First and second run differences

Within each condition, there was no difference in mean alerts between the first and second runs, except for NULL, where there were more alerts on the second run compared with the first run (paired $t[17] = -2.83$, $P = 0.01$).

Effect of marker on clean runs

Distribution of clean runs differed across unmarked and marked areas. There were more clean runs in unmarked areas (NULL and UNMARKED DECOY combined) ($n = 15$) than in marked areas (MARKED NULL and MARKED DECOY combined) ($n = 6$), $X^2[1, 21] = 3.86$, $P = 0.05$. In contrast, distribution of clean runs was not different across runs with and without decoy scent (NULL and MARKED NULL combined, $n = 11$, compared with UNMARKED DECOY and MARKED DECOY combined, $n = 10$), $X^2[1, 21] = 0.05$, $P = 0.827$.

Human and dog influences on alert locations

Alert locations in conditions marked with paper (MARKED NULL), containing decoy scent (UNMARKED DECOY) and containing decoy scent marked with paper (MARKED DECOY) were compared to evaluate differences of human influence on handler beliefs and dog influence on handler beliefs. Runs were grouped according to whether any one of the alerts in that run (1) included the marker and/or decoy scent; (2) did not include the marker and/or decoy scent; or (3) the run was clean (no alerts). These groups were dependent on condition, log likelihood [4, 108] = 22.236, $P < 0.001$, $\Phi = 0.41$ (Fig. 2). There were significantly more runs including alerts on the marker than either clean runs or runs not including alerts on the marker in both MARKED NULL ($X^2[1, 36] = 21.78$, $P < 0.001$) and MARKED DECOY ($X^2[2, 36] = 36.5$, $P < 0.001$) (Fig. 2). This was different than UNMARKED DECOY, where there were no differences between clean runs, runs with alerts on the decoy scent and runs not including alerts on the decoy scent ($X^2[2, 36] = 4.67$, $P = 0.09$) (Fig. 2). Conversely, comparing across conditions (black bars, Fig. 2), there were more runs with alerts on marked locations in MARKED NULL and MARKED DECOY than UNMARKED DECOY, although the differences were not significant when corrected for multiple comparisons (Fig. 2).

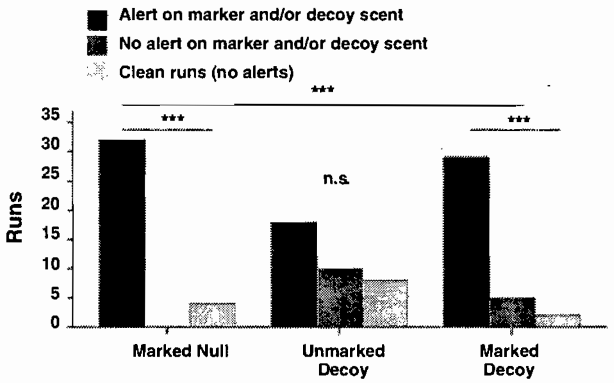

Fig. 2 Runs within each condition (combined n 36) with alerts including marker and/or decoy scent (*black bars*), not including marker and/or decoy scent (*dark gray bars*), or clean runs (*light gray bars*). Asterisks represent statistically significant differences between groups as shown by log likelihood (across all conditions) and chi squared test (within conditions); ***$P < 0.001$; n.s. not significant

Trend analysis

Finally, counterbalancing run order across participants ensured that each participant ran conditions in a different order. To evaluate whether there was an effect of sequence order of runs on alerts, all runs were reordered to reflect the sequence in which participants completed the conditions. Trend analysis was performed relating condition order to the number of alerts per run. An analysis of the cubic component of trend was significant, $F(1, 17) = 7.67$, $P = 0.01$, $\eta_p^2 = 0.31$, indicating that this trend accounted for over one-third of the variance in number of alerts per run (Fig. 3, solid line). This trend was consistent across both days of testing (Fig. 3, dotted and dashed lines).

Discussion

The goals of this study were to (1) identify whether handler beliefs affect detection handler/dog team performance and (2) evaluate relative importance of dog versus human inputs on those beliefs. To test this, we influenced handler beliefs and evaluated subsequent handler/dog team performance according to handler-identified alerts. The overwhelming number of incorrect alerts identified across conditions confirms that handler beliefs affect performance. Further, the directed pattern of alerts in conditions containing a marker compared with the pattern of alerts in the condition with unmarked decoy scent suggests that human influence on handler beliefs affects alerts to a greater degree than dog influence on handler beliefs. That

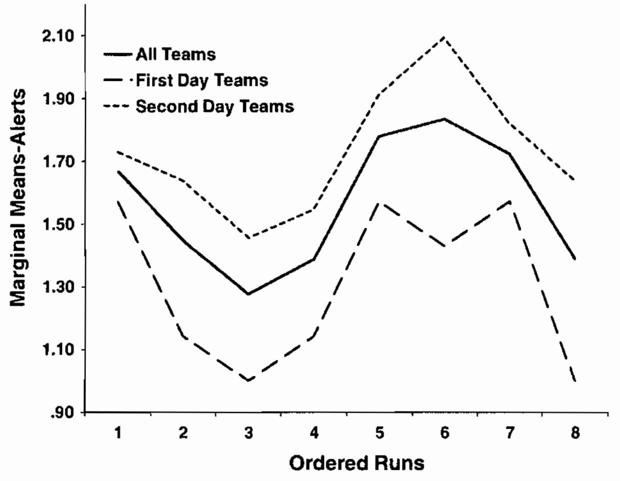

Fig. 3 Cubic trend for all teams (*solid black line*, n 18) relating condition run order (ordered runs) to marginal means of alerts per run as shown by trend analysis, P 0.01, η_p^2 0.31. Trends for teams from first day (*dashed line*, n 7) and second day (*dotted line*, n 11) are also shown for comparative purposes

is, total number of alerts identified by handlers did not differ across conditions. However, distribution of these alerts did differ across conditions; more alerts were identified on target locations indicated by human suggestion (paper marker) than on locations indicated by increased dog interest (hidden sausage and tennis balls).

In light of written and verbalized instructions that "Each scenario may contain up to 3 of your target scents," it was interesting that there were 12 runs with either four or five alerts (Fig. 1). It was unclear whether handlers did not attend to the instructions, did not remember the instructions or believed that there were more than three target scent sources in each condition.

There are two possible explanations for the large number of false alerts identified by handlers. Either (1) handlers were erroneously calling alerts on locations at which they believed target scent was located or (2) handler belief that scent was present affected their dogs' alerting behavior so that dogs were alerting at locations indicated by handlers (that is, the Clever Hans effect).

In the event that handlers were indeed asserting dog alerts regardless of dog response (or lack thereof), there are two possible causes. The handlers' beliefs that scent was present may have been sufficient motivation to identify alerts even when the handlers were clearly aware that the dog had not provided the trained alert response behavior. Alternatively, the handlers' beliefs were sufficient to generate a form of confabulation. Broadly defined, confabulation refers to false beliefs that may be unrelated to actual experienced events (Bortolotti and Cox 2009). Information regarding prevalent events (events that are common and therefore of increased likelihood) makes events more self-relevant and increases beliefs in occurrence of such events (van Golde et al. 2010). Thus, the perceived likelihood that scent was present across conditions would have contributed to confidence in handler beliefs of scent and dog responses. Because other-generated suggestions influence beliefs and subsequent actions more strongly than self-generated suggestions (Pezdek et al. 2009), the experimenter-provided suggestion that target scent was present may have further contributed to this effect. However, the conclusion that handlers are asserting their dogs have alerted simply upon seeing the marked areas regardless of actual dog response does not account for the numerous additional alerts occurring in other areas. In addition, the experimenter was informed that three handlers admitted to overtly cueing their dogs to alert at the marked locations, suggesting that handlers would not call alerts unless and until they observe the dogs' trained responses. Handlers are trained to recognize and reward specific behaviors of their dogs. The exhibition of an alert is an obvious and discrete behavior. Although data describing observer assessments were not collected, all observers were familiar with detection dog training and performance, and all observers were visibly surprised upon debrief (L. Lit, personal communication). Therefore, it is unlikely, although cannot be absolutely confirmed, that handlers called alerts on markers without seeing an appropriate behavior from the dog.

It may be more parsimonious to suggest that dogs respond not only to scent, but to additional cues issued by handlers as well. This is especially plausible since, in training, alerts are originally elicited through overt handler cueing. Cueing in initial training may include overt cues, verbal commands and physical prompting. Cues may also include more subtle unintentional cues given by handlers such as differences in handler proximity to the dog according to scent location, gaze and gesture cues, and postural cues.

Human cues that direct dog responses without formal training include pointing, nodding, head turning and gazing (reviewed in Reid 2009). While formal obedience training can enhance dogs' use of human cues (McKinley and Sambrook 2000), type of training can differentially affect dogs' human-directed communicative behaviors (Marshall-Pescini et al. 2009, 2008). Gazit et al. (2005) found diminished response when an area searched repeatedly was lacking target scent. While the proposed reason for their findings emphasized effects of context specificity on the detection dogs (Gazit et al. 2005), the current findings raise the possibility that at least some of the effects of Gazit et al. (2005) might have arisen due to handler beliefs that scent would not be present in that area, with subsequent attenuation of dog response.

Because the current study did not include videotape of handler/dog team performance, there is no way to identify

Table 2 Alert locations and alert frequencies (#) in each location for all scenarios

NULL		MARKED NULL		UNMARKED DECOY		MARKED DECOY	
Alert location	#	Alert location	#	Alert location	#	Alert location	#
Air conditioner	11	MARKER	32	DECOY SCENT	18	MARKER	29
First aid kit	10	Easel	9	Piano	15	Clear bin	12
Wall heater	9	Tall cabinet	6	Wall heater	7	Oven	3
Right window	7	Cart	3	Red bag	6	Tool box	3
Tall cabinet	5	Chalkboard	3	Radiator	5	Gray tote	2
Desk	4	Blinds	1	Upholstered chair	3	Above boxes	1
Short cabinet	4	Desk chair	1	Shelf	1	Back table	1
Trash can	4	Pedestal	1	Table	1	Doorway	1
Map on chalkboard	1	Trash can	1			Painted box	1
Pencil sharpener	1					Paint container	1
Table	1					Trash can	1
Totals	57		57		56		55

which conclusion would be appropriate. Observer coding of dog behavior was not likely to improve the reliability of the data acquired because the double-blind study design had the potential for the observers to be subject to the same biases as the handlers. In fact, it is possible that the observers were subject to greater biases than the handlers, since they were able to observe every dog twice. Therefore, observer coding would have been subject to the same possible explanations as the handlers, and further subject to question according to level of observer experience with working dogs. Future studies should directly explore underlying factors responsible for the false alerts as this will improve development of effective remedies to optimize performance.

Dogs can learn to respond to human gestures very rapidly (Bentosela et al. 2008; Elgier et al. 2009; Udell et al. 2008). Thus, it is tempting to speculate that the large number of false alerts resulted from reinforcement of dogs for false alerts received in earlier conditions. However, the pattern of alerts, consistent across days of testing (Fig. 3), suggests that alerts did not reflect a simple learning effect. This is supported by prior studies of human dog social cognitive interactions demonstrating no clear learning effect when comparing early with later trials (Hare et al. 2002; Riedel et al. 2008).

When considering alternative explanations for the incorrect responses, it is further possible that some alerts resulted from target scent contamination during initial setup of conditions. This is unlikely, given the emphasis of alerts toward marked sites, particularly when considering that the pattern of alerts was modified by human influence. The array of alert locations (Table 2) also does not support this explanation, notably because no dogs alerted on or around the doors where the scent containers had briefly been placed. Moreover, detection dogs are trained to identify scent source rather than scattered residual scent. For example, dogs trained to alert on gunpowder are not expected to alert in an airport area simply because an armed officer passes through. The significant trend (Fig. 3) further suggests that a temporal component contributed to the number of alerts under these experiments.

It is possible, although also unlikely, that all objects in the room smelled like the dogs' target scents. Because these were rooms in a church building that had not previously been used for detection dog training, it was also unlikely that there were explosives or drugs that had been stored within the testing rooms. Some handlers suggested the possibility that dogs were following previous dogs and alerting at locations in which these dogs had salivated or otherwise left trace evidence of their presence. This would not explain the difference in patterns of alerts between marked and unmarked conditions or the variation in alert locations across all conditions. This would also be unlikely given the extensive training and certification processes required of these teams.

It is important to emphasize that this study did not evaluate performance of dogs when presented with scent. Handler-dog teams undergo substantial training and rigorous certification prior to deployment; all teams included in this study confirmed prior successful finds during active deployment. This study only considered number of alerts under the artificially manipulated condition of handler belief of scent when in fact no scent was present.

In conclusion, these findings confirm that handler beliefs affect working dog outcomes, and human indication of scent location affects distribution of alerts more than dog interest in a particular location. These findings emphasize the importance of understanding both human and human dog social cognitive factors in applied situations.

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